

FIG. 1


FIG. 3A shows a software interface with two main sections. The top section, labeled 68, is a 'Process Indicator' (70) showing a list of tasks: '1) Still To Do: Prepare Boundary Diagram' and '2) Next To Do: Prepare Interface Diagram'. The bottom section, labeled 66, contains two task cards. The first card, labeled 72, is for '1) PREPARE BOUNDARY DIAGRAM' (118) and includes a text input field with up/down arrows and a file attachment icon with the text 'Click to attach file here'. The second card, labeled 120, is for '2) PREPARE INTERFACE MATRIX DIAGRAM' and includes a similar text input field and file attachment icon.

FIG. 3A


Item	Function	Potential Failure Mode	Potential Effect(s) of Failure	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Design Controls Prevention	Current Design Controls Detection	RPN	Recommended Action(s)	Responsibility & Target Completion Date	Action Results			
												Actions Taken	Sev	Occ	Det
28													36	58	60
30															
32															
34															
36															
38															
40															
42															
44															
46															
48															
50															
52															
54															
56															
58															
60															
62															

FIG.2

130 118 ☐ 3 PREPARE PARAMETER DIAGRAM
Attach a file containing the Parameter Diagram for this FMEA. Input comments below.

 Click to attach the file here

154 118 ☐ 4 GENERATE FMEA FORM
Attach file containing the FMEA Form. Input comments below.

 Click to attach file here

162 118 ☐ 5 REVISE FMEA FORM
Attach file containing the revised FMEA Form. Input comments below.


 Click to attach file here

FIG.3B

BOUNDARY DIAGRAM

Automatic Transmission Shift Quality Example

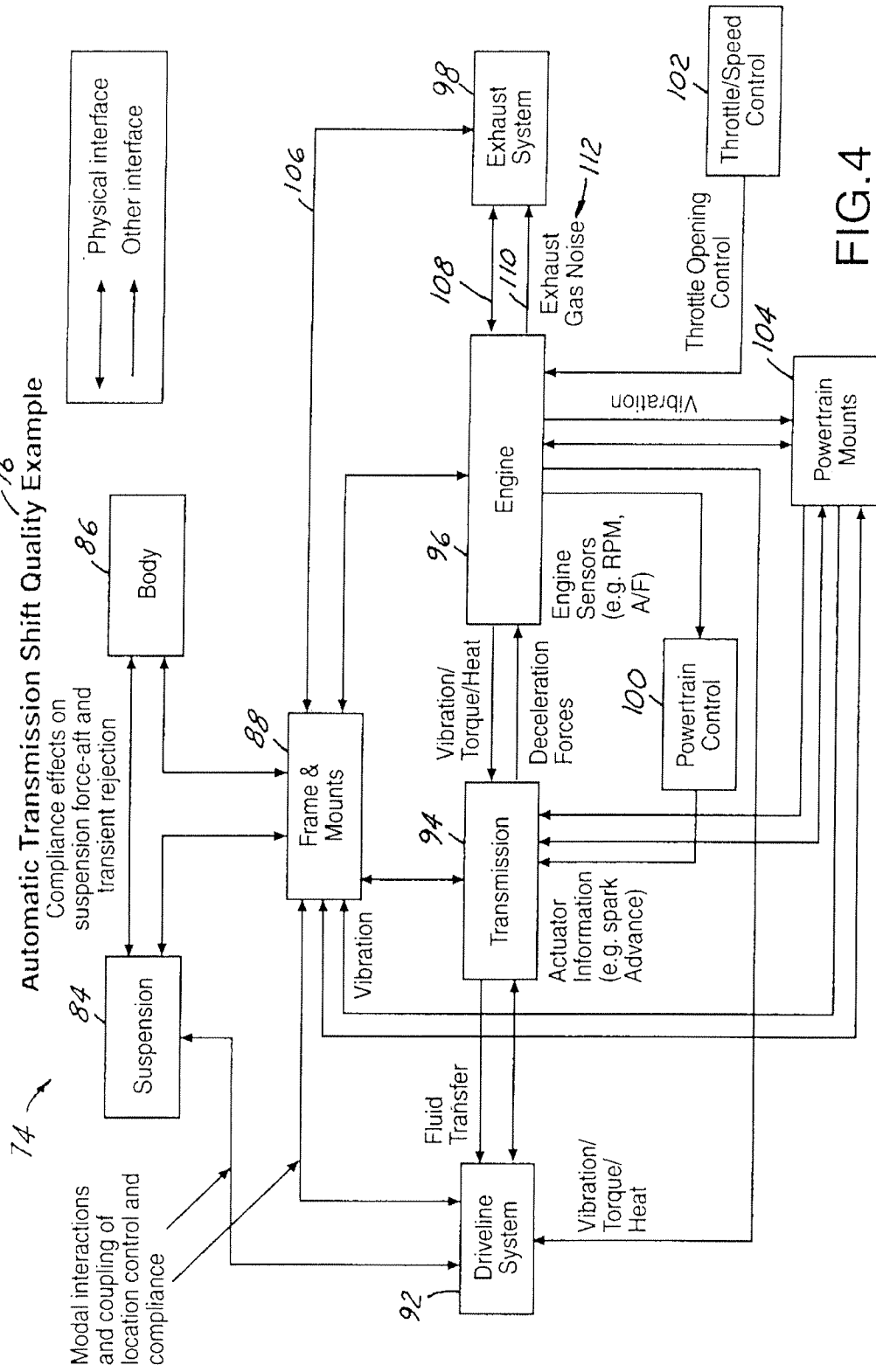


FIG.4

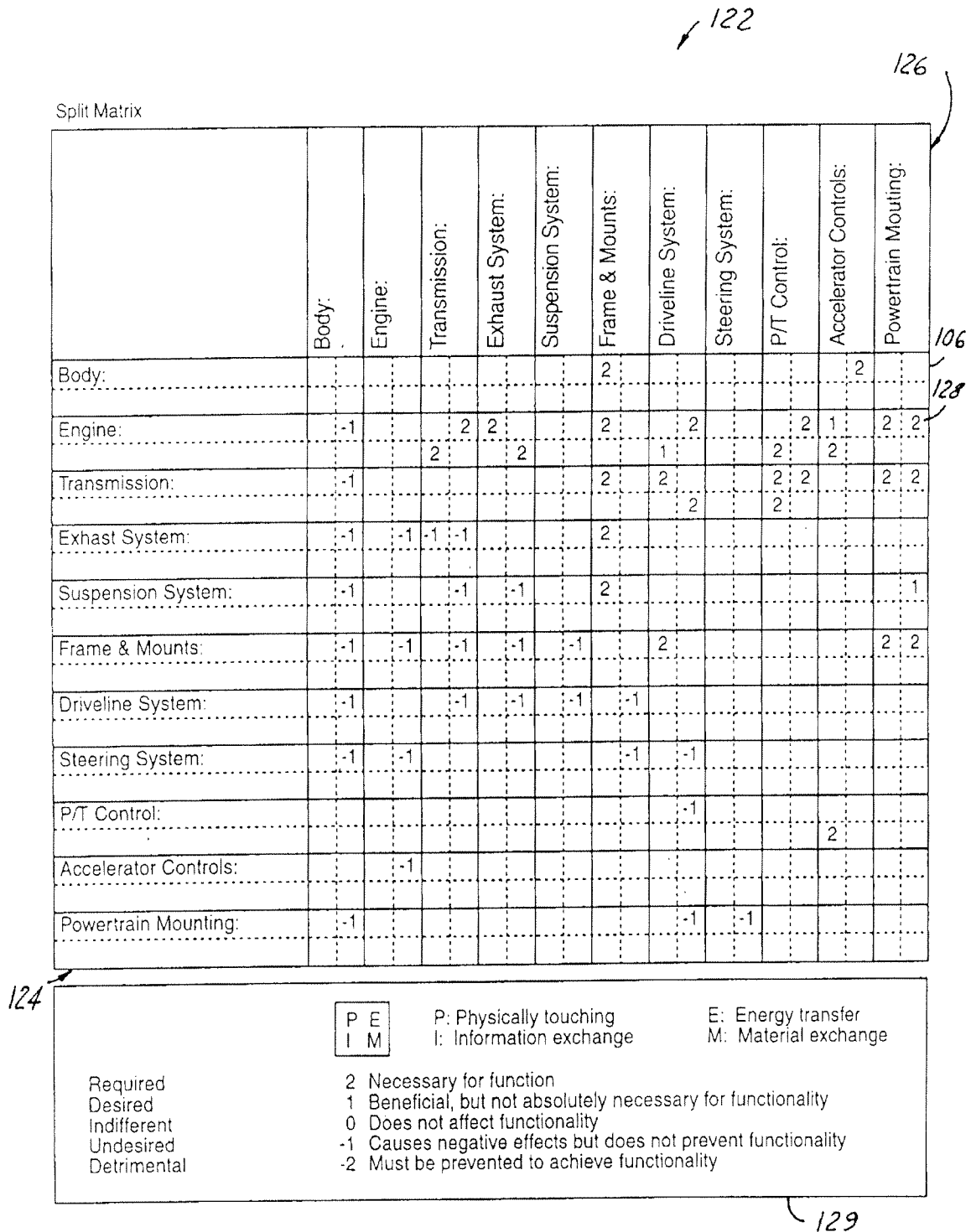
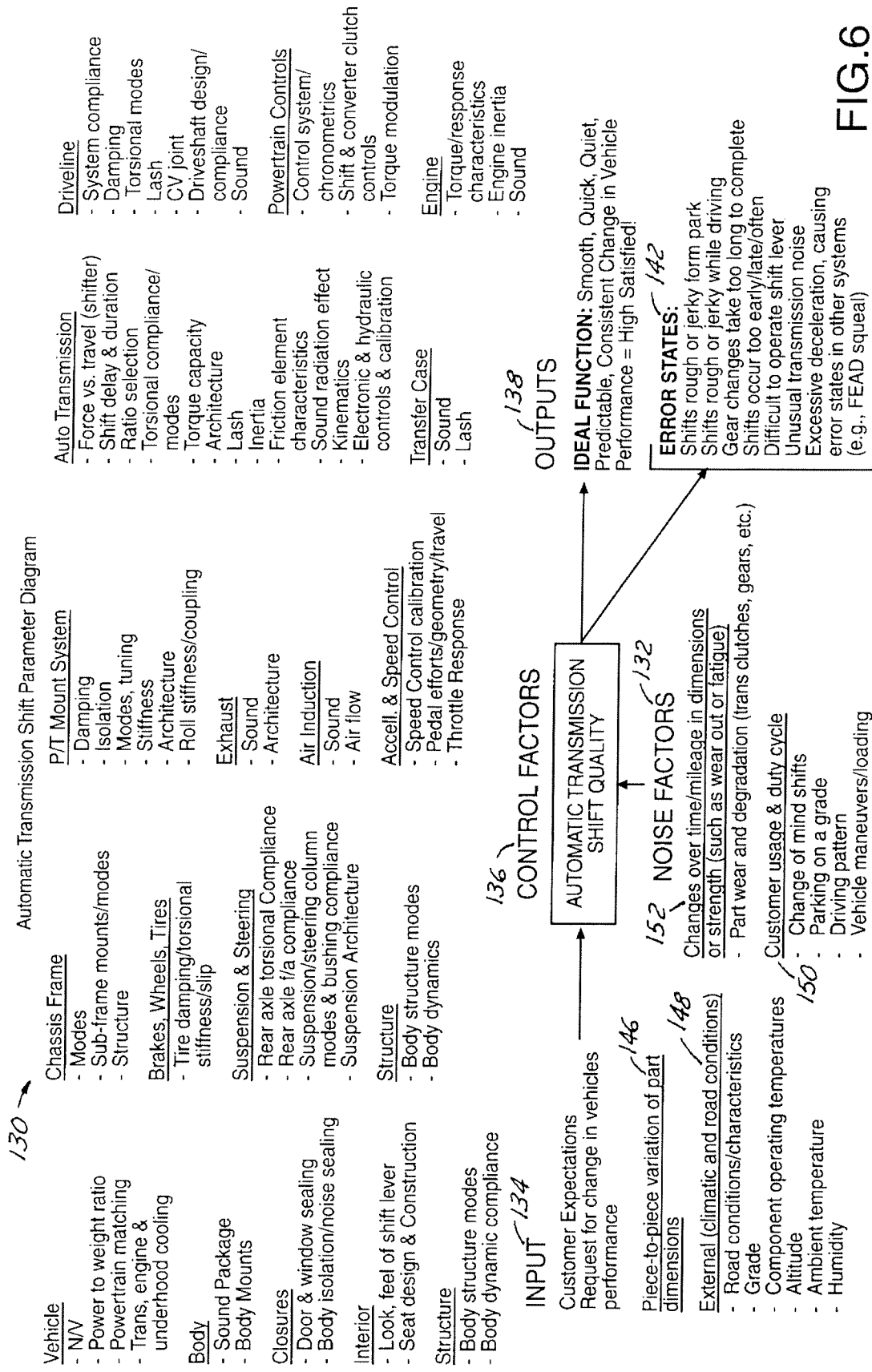


FIG.5



136 **CONTROL FACTORS**

138 **OUTPUTS**

134 **INPUT**

Customer Expectations
Request for change in vehicles performance

146 Piece-to-piece variation of part dimensions

148 External (climatic and road conditions)

- Road conditions/characteristics
- Grade
- Component operating temperatures
- Altitude
- Ambient temperature
- Humidity

150 Customer usage & duty cycle

- Change of mind shifts
- Parking on a grade
- Driving pattern
- Vehicle maneuvers/loading

132 **AUTOMATIC TRANSMISSION SHIFT QUALITY**

152 **NOISE FACTORS**

Changes over time/mileage in dimensions or strength (such as wear out or fatigue)

- Part wear and degradation (trans clutches, gears, etc.)

IDEAL FUNCTION: Smooth, Quick, Quiet, Predictable, Consistent Change in Vehicle Performance = High Satisfied!

ERROR STATES:

- Shifts rough or jerky form park
- Shifts rough or jerky while driving
- Gear changes take too long to complete
- Shifts occur too early/late/often
- Difficult to operate shift lever
- Unusual transmission noise
- Excessive deceleration, causing error states in other systems (e.g., FEAD squeal)

FIG.6

Item/Function	Potential Failure Mode	Potential Effect(s) of Failure	Sv	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Controls
							Prevention
<p>Function: Needs, Wants, Requirements</p> <p>Must be verb-noun measurable or constraints</p> <p>Methods: Brainstorm</p> <p>Input Include: Function tree, Previous/ similar FMEAs, SDS, Boundary Diagram, QFD</p>	<p>4 Thought Starters: No function Partial /over function/degraded over time Intermittent Function Unintended function</p> <p>Methods: Brainstorm using 4 Thought Starters List each in separate field</p> <p>Input include: P-diagram, Interface matrix, Similar FMEAs, 8D's, Warranty, TGW</p>	<p>Including: Government/safety Ultimate Customer, Vehicle, Other systems, Subsystems, Components, Item, Manufacturing/ assembly/service</p> <p>Methods: Brainstorm, Rate each; put highest in next column</p> <p>Inputs include: P-diagram, Interface Matrix, Warranty, 8Ds, TGW Previous similar FMEAs</p> <p>For classification: See FAP03-111 or Section 6 of this Handbook. As of this date = YC or YS or blank.</p>			<p>For cause: Why has this happened or how might this happen?</p> <p>Use 2 assumptions: 1) Item will be manufactured/ assembled to specification 2) Design includes a deficiency that may cause unacceptable variation</p> <p>Methods: 1) Brainstorm 2) Rate each occurrence-put in next column</p> <p>Inputs include: Warranty, 8D, TGW, Previous/similar FMEAs, P-diagram, test data</p>		<p>Controls are already planned, or are normal and customary for this type item</p> <p>Remember that Prevention Controls have and affect on the Occurrence</p> <p>Inputs include: Warranty, 8D, TGW, Previous/ similar FMEAs, Test data, Previous DV plan, P-diagram</p>
<p>Catalytic Converter must suppress the generation of Sulfur odor (H2S) that can be detected by the customer (rotten egg smell) (ppm/test H2S) for target life of vehicle. (10yr/150K MI) (PZEV, 15yr/ 150K MI)</p>	Excessive release of H2S	Customer dissatisfaction (Unpleasant Odor) (Rotten Egg Smell)	7	YS	<p>Improper Calibration:</p> <p>1) Rich A/F excursions - during transients - at idle - Canister purge at idle and during low speed cruises</p> <p>2) Lean A/F excursions - during transients - during decels with coordinated with fore-aft oxygen control</p> <p>3) Catalyst Temperature Model false triggering of enrichment</p> <p>4) Closed loop fuel control - peak-to-peak amplitude (>0.03 lambda)</p> <p>5) Tailpipe O2 - minor amount (<0.03%) not present to ensure that SO2 can be liberated from NiO added to catalyst (during cruises and decels)</p>	5	<p>1. Review Calibration Guides for H2S prevention.</p> <p>2. Review related G8D: #24094 U152 Sulfur Odor.</p> <p>3. Search Technical Service Bulletin (TSB) database for H2S, Sulfur, Smell, Rotten Egg Smell.</p> <p>4. Campaign Prevention Reviews.</p> <p>5. Calibration Technical Reviews.</p>

FIG.7A

Current Design Controls Detection	Detec	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
					Actions Taken	Sev	Occ	Det	R.P.N.
<p>Current Controls are 2 types: 1) Prevent a cause/mechanism of failure 2) Detect the failure mode or detect the cause/mechanism of failure</p> <p>Methods: 1) Rate each detective control 2) Put best (lowest) or composite in the Detection column. 10 if no detection.</p>			<p>List the action. If no action planned, enter "None" or "None at this time".</p> <p>Must have a recommended action for any special Characteristic item.</p>	<p>Enter who (not just the department), will complete and when. 11/5/2003</p>	<p>Enter a brief description of the action after it has been completed.</p> <p>Enter the revised Severity, Occurrence, and detection number to the right to reflect the results of the action.</p> <p>Recalculate</p>				
			<p>It is possible to have multiple actions against a cause or failure mode.</p>	<p>There should be a name here, XYZ department. 5/10/2003</p>					
<p>VEHICLE ARL Emissions Attribute requirement 02-0260 for Calibration 10-pager (23-0002) H2S Emissions test (6) Associated DVM: DVM 0030-23 DVM 0031-23 DVM 0037-23 DVM 0007-23 DVM 0001-23 DVM 0011-23 DVM 0017-23 Vehicle tests: Objective H2S Test Ns31 Subjective H2S Test CETP 00.00-R-221</p>	6	210	<p>1) Reduce APTL Mass Spec testing variability. 2) Develop ppm/test acceptance criteria that correlated to customer field concerns.</p>	<p>J. Sloss, M. Dennis, J. Scaparo, M. Lieborwitz 1 May 2003</p>	<p>Release updated APTL Standard H2S Test For Sign-Off (NS33) CETP 00.00-L-931</p> <p>Deleted subjective test CETP 00.00-R221</p>	7	3	2	42
			<p>(Update, released & published Corporate Quality Documents (DFMEA, Calibration Guides, CETP)</p>	<p>1) Reduce APTL Mass Spec testing variability 2) Develop ppm/test acceptance criteria that correlated to customer field concerns.</p>	<p>Released and published Corporate Quality Documents to EKB.</p>				

FIG.7B

140

142

146

152

164

174

176

178

180

182

184

186

188

190

192

194

196

198

200

202

204

206

208

210

212

214

216

218

220

222

224

226

228

230

232

234

236

238

240

242

244

246

248

250

252

254

256

258

260

262

264

266

268

270

272

274

276

278

280

282

284

286

288

290

292

294

296

298

300

302

304

306

308

310

312

314

316

318

320

322

324

326

328

330

332

334

336

338

340

342

344

346

348

350

352

354

356

358

360

362

364

366

368

370

372

374

376

378

380

382

384

386

388

390

392

394

396

398

400

402

404

406

408

410

412

414

416

418

420

422

424

426

428

430

432

434

436

438

440

442

444

446

448

450

452

454

456

458

460

462

464

466

468

470

472

474

476

478

480

482

484

486

488

490

492

494

496

498

500

502

504

506

508

510

512

514

516

518

520

522

524

526

528

530

532

534

536

538

540

542

544

546

548

550

552

554

556

558

560

562

564

566

568

570

572

574

576

578

580

582

584

586

588

590

592

594

596

598

600

602

604

606

608

610

612

614

616

618

620

622

624

626

628

630

632

634

636

638

640

642

644

646

648

650

652

654

656

658

660

662

664

666

668

670

672

674

676

678

680

682

684

686

688

690

692

694

696

698

700

702

704

706

708

710

712

714

716

718

720

722

724

726

728

730

732

734

736

738

740

742

744

746

748

750

752

754

756

758

760

762

764

766

768

770

772

774

776

778

780

782

784

786

788

790

792

794

796

798

800

802

804

806

808

810

812

814

816

818

820

822

824

826

828

830

832

834

836

838

840

842

844

846

848

850

852

854

856

858

860

862

864

866

868

870

872

874

876

878

880

882

884

886

888

890

892

894

896

898

900

902

904

906

908

910

912

914

916

918

920

922

924

926

928

930

932

934

936

938

940

942

944

946

948

950

952

954

956

958

960

962

964

966

968

970

972

974

976

978

980

982

984

986

988

990

992

994

996

998

1000

FIG. 8A

152

NOISE FACTOR 2: COMPONENT CHANGES OVER TIMMILEAGE - Over Useful Life Period											
Change in dimension or change in strength over Useful Life Period (assumptions above)	a)	glovebox hinge dimensions (wear)	X	X	X	X	III	Process Charact.	1	C	F
	b)	wear between mating parts	X	X	X	X	III	Process Charact.	2	1	C
	c)	change in rigidity characteristics of COB	X	X	X	X	III	Process Charact.	2	1	C
	d)	part shrinkage/distortion	X	X	X	X	III	Mat. Spec. Check	2	1	C
	e)	entirement of plastic components	X	X	X	X	III	Mat. Spec. Check	2	1	C
	f)	torque loss at fixings over time	X	X	X	X	III	Process Charact.	1	C	D
Other material or chemistry variation	h)	glovebox bump stops hardened	X	X	X	X	III	Mat. Spec. Check	2	1	C
	i)	PVC leaching (plasticizer)	X	X	X	X	III	Process Charact.	2	1	C
	j)	plastic creep under load	X	X	X	X	III	Process Charact.	1	C	E
	k)		X	X	X	X	III	Process Charact.	1	C	C
"Break-in" and/or in-use hysteresis											
NOISE FACTOR 3: DUTY CYCLE / CUSTOMER USAGE - Over Useful Life Period											
"Typical" Customer Usage over Useful Life Period (assumptions above)	a)	disassembly for service	X	X	X	X	V	Service Manual	1	C	C
	b)	road conditions	X	X	X	X	V	TBE	2	1	C
	k)	component servicing	X	X	X	X	V	Service Manual	2		C
Transport, storage, dewaxing			X	X	X	X					
Customer misuse/ abuse	c)	spillage of liquids & food stuffs	X	X	X	X	TBE		1	C	A
	d)	IP Scratching	X	X	X	X	TBE		1	C	D
	e)	overloading glovebox	X	X	X	X	TBE		1	C	
	f)	leaning on IP	X	X	X	X	TBE		1	C	
	g)	feet on instrument panel	X	X	X	X	TBE		1	C	

150

FIG.8B